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1.0 GENERAL

.1 Design, labour, products, equipment, and services necessary for irrigation work in accordance with the Contract Documents.

1.1 Related Work

.1 City of New Westminster Bylaw 7142-2007 Schedule B, Design Criteria

.2 City of New Westminster Waterworks Regulation Bylaw 7631

1.2 Codes and Permits

.1 All work shall be installed in accordance with the requirements of local and applicable provincial and federal regulations. Any work shown on the drawings or described in the specifications which is at variance with the regulations shall be changed to comply with the requisite authority at no cost to the City.

.2 Worksafe BC regulations shall be followed.

.3 The Contractor shall be responsible for obtaining all permits and licenses required to undertake and complete the work. Include costs for required permits and approvals in tendered prices.

.4 Provide the Contract Administrator with signed and approved copies of all required permits, including the following:

(i) Backflow test report
(ii) Technical Safety BC Electrical Contractor Authorization and Declaration of Compliance Electrical Inspection Request Form.

1.3 Quality Assurance

.1 Manufactured products, including but not limited to irrigation heads, quick couplers, controllers, valve boxes, and valves, will be warrantied according to the manufacturer’s standard warranty period or a minimum of one (1) year, whichever is greater.

.2 The double-check valve assembly and meter shall be installed and tested by a certified and licensed backflow tester with B.C.W.W.A.

.3 All electrical components or products specified or used in the construction of the proposed irrigation system must be CSA-approved and installed in accordance with all local, provincial, and national electrical codes.

.4 All materials are to be new and without flaws.

.5 The completed irrigation system shall efficiently and uniformly irrigate all areas and perform as required by these specifications.

.6 A City shall designate an irrigation technician as a representative to attend all inspections.

.7 The Contractor shall call for a pre-construction meeting with the Contract Administrator and the City representative before the start of the irrigation installation.

1.4 Site Conditions

.1 Verify the existence and location of all underground utilities and services before the commencement of the work.

.2 Consult with the Owner's Representative to adjust the design, if necessary, to suit existing site conditions and grades before commencement of the work.

.3 Ensure that irrigation work is sequenced in coordination with the work of other trades and that sleeves, wire, pipes, valves, and other equipment are installed when appropriate.

.4 Plan, schedule, and execute work to ensure a water supply is available for landscape establishment and maintenance purposes at the appropriate time, in adequate amounts, and operating at design pressures to ensure satisfactory irrigation of all landscaped areas.

.5 Report to the Contract Administrator in writing any conditions or defects encountered on the site during or before construction, which depend on the work of this section and may adversely affect its performance.

.6 Protect from damage to existing landscape features, plant material, structures, irrigation work in progress, and the work of other trades. At no expense to the owner, make good any damage resulting from the work completed as part of this Contract.

.7 The contractor shall bring only vehicles or equipment that are essential for the construction of the system onto the site.

.8 Trenching and other excavations for vaults, valve boxes, etc., are not to be left open during non-work hours unless they are protected to current WorkSafe BC standards. Cover, clearly mark, and protect all open excavations to ensure public safety.

.9 The contractor shall employ the appropriate skilled trades to repair all damage to underground services caused by the work of this Contract. Damage to services that are shown on the Contract Drawings or have been brought to the Contractor's attention in the field before commencement or during construction of the work shall be repaired at the Contractor's expense. Repair of damages to underground services where the location of services was unknown after all reasonable measures were taken by the Contractor to ascertain the existence of these services will be paid for by the Owner.

.10 The Contractor shall cooperate with the Owner and utility providers to keep their respective utilities in operation.

1.5 Substitutions

.1 Where materials are specified by brand name and model number, such specifications shall be deemed to facilitate a description of the materials and material quality and establish a standard for performance and quality against which proposed substitutes shall be evaluated.

.2 Substitution requests shall not be considered unless submitted in writing with sufficient descriptive literature and product samples to permit product comparison.

.3 All product substitutions shall have equal or greater performance, value, and water efficiency than the original design. All proposed sprinkler substitutions must be accompanied by verifiable water efficiency performance data from the manufacturer or an independent industry source.

.4 Alternate materials shall match the specified materials in performance, flow, and pressure loss so as not to compromise the intent of the design.

.5 The written approval of the Owner's Representative is required for the use of materials different from those shown in the design. Materials installed which have not been pre-approved by the Owner's Representative are subject to removal and replacement with approved materials at the Contractor's expense.

.6 Substitution requests by the Contractor shall have no impact on Milestone Dates.

1.6 Submittals

.1 Provide a Certified Irrigation Contractor certificate with the Irrigation Industry Association of BC or the Irrigation Association within five days of receipt of the Notice to Proceed.

.2 Provide a Class C-R Low Energy field safety representative certificate of qualification and Electrical Contractor License within five days of receipt of Notice to Proceed.

.3 Provide Backflow Assembly tester certificate within five days of receipt of Notice to Proceed.

.4 If the irrigation design involves High-Density Polyethylene (HDPE) pipe, the Contractor shall submit a certificate in High-Density Polyethylene Butt-Fusion within five days of the Notice to Proceed.

.5 The Contractor shall submit shop drawings for approval by the Owners Representative prior to construction. Shop Drawings of the irrigation system are required for all aspects not included in the Drawings. This includes but is not limited to:

(i) Revisions to irrigation system design not previously addressed in Contract Documents, including revisions that markedly alter the original design, as determined by the Contract Administrator.
(ii) Installation details for irrigation components not addressed in the Contract Documents.
(iii) Details required by Contract Administrator for review of proposed substitutes.
(iv) Tasks identified in project specifications as requiring a shop drawing.
(v) Submit shop drawings to the Contract Administrator for review, comment, and approval or rejection.

.6 The Contractor shall submit product literature for approval by the Owners Representative prior to the start of construction.

.7 Provide Electrical Installation Permit and Electrical Contractor Authorization and Declaration of Compliance Electrical Inspection Request upon permit issuance.

.8 Submit a complete set of Record Drawings to the Contract Administrator prior to the issuance of a Certificate of Substantial Performance. Include a digital copy in .pdf and .dwg format, hard copies in full and half-size, and a half-sized laminated copy in the controller cabinet.

.9 Submit complete Operating Manual to Contract Administrator prior to issuance of Substantial Performance. Provide one (1) hard copy in a binder and one (1) digital copy.

.10 Submit a written guarantee to the Contract Administrator prior to the issuance of Substantial Performance.

1.7 Irrigation Record Drawings

.1 Maintain accurate scaled records of installed irrigation system and its components on a marked-up set of Contract Documents daily during Construction. Show all deviations from Contract Drawings. Make marked-up Contract Drawings available to the Contract Administrator upon request.

.2 For sports fields and large parks, retain a qualified survey instrument operator to record the exact locations of all installed irrigation components, including changes in the direction of the pipe.

.3 The Record Drawings shall be submitted within 14 days of issuance Substantial Completion. Submit one (1) full-sized copy, one (1) half-sized copy, and one (1) half-sized laminated copy. Submit digital copies in .pdf and .dwg format with the digital submission of the Operating Manual.

.4 The Record Drawings must clearly and legibly show all components of the irrigation system as installed. The Record Drawings must include the following:

(i) Identify each zone numerically, complete with precipitation rate and GPMs per zone.
(ii) Scale and north arrow.
(iii) Legend of all equipment installed, complete with make and model of each product.
(iv) Date of installation.
(v) Irrigation water schedule.

1.8 Operating Manual

.1 Prepare a complete Operating Manual for the installed irrigation system. The Operating Manual shall be submitted within 14 days of issuance of Substantial

Completion. The content of the Operating Manual must include:

(i) Product literature and warranty documentation.
(ii) Equipment operating instructions.
(iii) Maintenance instructions, including spring start-up and winterization procedures.
(iv) Copies of all irrigation inspection reports and test results.
(v) Copies of the backflow test report and Electrical Permit.

.2 A written guarantee statement covering workmanship and materials shall be provided to the Owner for at least one (1) year from the date of substantial completion. The contractor shall warranty maintenance on the system for a minimum of one (1) year, including but not limited to spring start-up, adjustments and maintenance operations as required, and winterization. The Contractor will also attend a warranty inspection before handover.

1.9 Measurement for Payment

.1 The supply and installation of the irrigation system and its associated components will be paid according to the unit measures shown in the Schedule of Quantities and Prices.

.2 Irrigation prices shall include all labour, permits, tests, warranty, equipment, and materials required to complete the contract requirements as shown on the Contract Documents.

1.10 Tests and Inspections

.1 Components will be inspected and tested at various milestones during construction to ensure the irrigation system's performance meets expected standards.

.2 Provide equipment and personnel necessary for the performance of inspections and tests.

.3 Conduct all inspections and tests in the presence of the Contract Administrator and request the Contract Administrator issue a signed report to the Contractor within three days regarding each test result.

.4 Keep work uncovered and accessible until successful completion of inspection or test.

.5 As a condition of issuance of a Certificate of Substantial Performance, confirm in writing to the Contract

Administrator the following inspections and successful tests:

(i) Backflow Assembly Test
(ii) Point of Connection inspection.
(iii) Trench inspection.
(iv) Mainline pressure test.
(v) System coverage and operation test.
(vi) Dripline emitter test.
(vii) HDPE pipe strap test.
(viii) Vault drainage test.

.6 System installation inspections shall be held regularly.

1.11 Backflow Assembly Test

.1 Conduct backflow prevention assembly test as per BC Water Works Association standards using qualified personnel.

.2 Conduct backflow upon backflow assembly installation and submit a report to the Contract Administrator.

1.12 Point of Connection Inspection

.1 Conduct an inspection of the point of connection. Inspect all components, connections, wire splices, supports, and sizing.

.2 Call for inspection upon completing the installation of the point of connection.

1.13 Trench Inspection

.1 Open trench inspections shall be conducted throughout the irrigation installation for mainline, lateral piping, wire paths, and ground plates.

.2 The inspections shall verify the depth, bedding, joining procedures, splices, workmanship, and clearances are in accordance with the Contract Documents.

.3 The Contractor shall rectify any issues that are not in accordance with the Contract Documents and call for another inspection.

1.14 Mainline Pressure Test

.1 Perform mainline pressure test to identify potential leaks and ensure mainline can operate at design pressure and maintain pressure.

.2 Conduct mainline pressure test before backfilling of mainline.

.3 Fill the mainline with water and expel all air from the pipe. Maintain water in the pipe for 3 hours.

.4 Subject mainline to hydrostatic pressure of 120psi or twice the optimum design pressure of the mainline and not to exceed 160psi.

.5 Stop the supply of make-up water to the mainline and record hydrostatic pressure in the mainline.

.6 Inspect mainline and fittings for leaks.

.7 Record hydrostatic pressure in the mainline 3 hours after the supply of make-up water stopped.

.8 Determine test results based on differences in recorded pressures at the beginning and end of the test. A 5% difference or less is considered a pass.

.9 Identify the source of the leak and replace all defective material and workmanship as necessary to eliminate the leak.

.10 Repeat the mainline pressure test and make replacements as necessary until a passed result is achieved.

1.15 System Coverage and Operation Test

.1 The system coverage test shall be conducted before the issuance of Substantial Performance and at the one-year Warranty review.

.2 Conduct coverage and operation tests after installation and operation of the complete irrigation system. Inspect to confirm that:

(i) Head spacing does not exceed the distances shown on Contract Drawings, and head-to-head coverage is achieved.

(ii) Where applicable, irrigation piping should be installed to follow the contours of the land to minimize low-head drainage situations.

(iii) Heads, boxes, vaults, and trenches are at specified elevations relevant to the finished grade and not subject to settlement or lifting.

(iv) Valves are installed with the required clearances, materials, products, and connections.

(v) All irrigation components are installed with the required clearances, materials, products, and connections.

(vi) The controller can be programmed manually on-site.

(vii) The controller can send and receive communication with the Owner's central control system.
(viii) The controller responds to the flow sensor.
(ix) Operating pressure is within design parameters.
(x) Each zone can be operated automatically and in succession via the programmed controller.
(xi) There is no overspray onto different control zones, hard surfaces, or other improvements.
(xii) Review the accuracy of Record drawings.

1.16 Dripline Emitter Test

.1 Perform inspection and testing of the dripline/emitter manifold and lines to identify potential leaks and confirm that the manifold, driplines, and emitters can operate at design pressure. Conduct inspection and testing before backfilling the manifolds, driplines, or emitters.

.2 Fill the manifold and lines with water at operating pressure and maintain pressure for 15 minutes. Visually inspect manifolds, driplines, and fittings for leaks. Confirm that emitters are functioning correctly. Identify sources of leaks and replace all defective materials and workmanship as necessary to eliminate leaks.

.3 Repeat inspection and testing and make replacements as necessary until no further leaks are identified.

1.17 HDPE Pipe Strap Test

.1 Conduct an HDPE pipe strap test at least 1 hour after the fusion weld has been made before backfilling of HDPE pipe on those fusion welds where, upon visual or tactile inspection, the bead does not roll back correctly or is inconsistent in height or width.

.2 The HDPE pipe strap consists of:
(i) Cut fusion weld from the pipe, allowing 200mm on either side of the weld to work with
(ii) Cut pipe lengthways through fusion weld to create a strap 25mm wide.

.3 Bend strap back on itself.

.4 If the weld breaks, repeat the test on another fusion weld chosen by the Contract Administrator. If the second fusion weld fails, all welds become suspect, and the

HDPE pipe cannot be installed until the reason for the joint failures is determined.

.5 If the fusion weld does not break, then the weld is acceptable, and no further testing of similar welds is required.

.6 Replace or repair the tested pipe strap.

1.18 Vault Drainage Test

.1 Conduct vault drainage test when the vault is installed and backfilled.

.2 Plug the drain, fill the vault with water to a depth of 300mm, and leave the water to drain.

.3 Determine test results based on the time required for water to drain. The water must drain in 60 minutes or less to pass this test.

2.0 PRODUCTS

2.1 Electrical Products

.1 All electrical products shall be CSA-approved and bear the CSA label. Alternatively, where a product does not bear the required CSA label, it shall be approved in writing by the authority having jurisdiction.

.2 The wire conduit shall be a grey PVC DB2 non-metallic electric conduit, as shown on the drawings, with a minimum diameter of 50mm.

2.2 Electrical Service and Meter

.1 Unless already installed or otherwise required by the electrical utility having jurisdiction over the site, provide a metered electrical service, including but not limited to:

(i) Electrical permit.
(ii) Electrical meter.
(iii) Establishment and verification of electrical account with the appropriate utility provider.

.2 Type and size of electrical service to be as specified on Contract Drawings.

.3 Unless specified otherwise, an electric meter is to be supplied and installed per the standards and specifications of the electrical utility.

2.3 Irrigation Controller

.1 Acceptable controllers are Rain Bird's ESP-LXME2-PRO, and the ESP-LXIVM. Refer to Contract Drawings for specific models.

.2 Install powered controllers with Rain Bird cellular communication cartridge.

.3 Where power is unavailable, Rain Bird ESP-BAT-BT controllers will be acceptable with express permission from the City's project manager.

2.4 Controller Cabinet

.1 Acceptable controller cabinets are Rain Bird's LXMMSSPED Stainless Steel Pedestal with Rain LXMMSS Stainless Steel Cabinet or as shown on the Contract Drawings.

2.5 Control Wire

.1 The control wire from the irrigation controller to the electric control valve must be a minimum #14-gauge, direct burial, type TWU-40 wire, and it must be any colour other than white, blue, purple, or red.

.2 The common wire from the irrigation controller to the electric control valve is to be a minimum #14-gauge direct burial, type TWU-40 wire, white in colour.

.3 The master valve wire from the controller to the valve must be a minimum #14-gauge direct burial, type TWU-40 wire, and it must be red in colour.

.4 The spare control wire is to be blue in colour.

.5 The spare common wire is to be white in colour.

.6 All connectors will be new, two-step, CSA-approved for watertight applications and assembled according to the manufacturer's recommendations.

.7 Electrical marking tape to be 75mm yellow caution tape.

2.6 Two-Wire Conductor

.1 The two-wire conductor between the controller and the field decoders at the electric control valves shall be Rain Bird Maxi Wire.

.2 All control wires installed shall use a Polyethylene outer jacket.

.3 All connectors will be new, two-step, CSA-approved for watertight applications and assembled according to the manufacturer's recommendations.

2.7 Grounding and Bonding

.1 Ground assembly consists of CSA and BC Electrical Code endorsed products and per irrigation controller manufacturer's recommendations for grounding.

2.8 Wire Splice Box

.1 Wire splice box and matching lid and extensions to be commercial grade and grey in colour. Wire splice box to have locking overlapping lid with stainless steel bolt locking device and appropriate washers.

2.9 Water Service and Meter

.1 Unless already installed or otherwise required by the water utility having jurisdiction over the site, provide a metered water service, including but not limited to:

(i) Permit
(ii) Backflow prevention assembly
(iii) Establish and verify the water account with the appropriate utility provider.

.2 Supply and install a water meter in accordance with the requirements of the water utility.

.3 Conform the size of the water meter to the mainline diameter and allow for minimal pressure losses.

2.10 Vault and Lid

.1 Refer to Contract Drawings for acceptable vaults and lids for point-of-connection components.

2.11 Vault Drain

.1 Perforated Schedule 40 PVC pipe, 100mm diameter with threaded inlet cover having 13mm grated openings.

2.12 Backflow Prevention Assembly

.1 Acceptable double-check valve assemblies are :

(i) Watts Series LF007 Double Check Valve Assembly
(ii) Zurn Model 350 Double Check Valve Assembly
(iii) Watts Series 757-NRS Double Check Valve Assembly

2.13 Flow Sensors

.1 Flow sensors must be sized to match the system's low and high flows. Acceptable flow sensors shall be Rain Bird Ultrasonic Series flow sensors.

2.14 Master Valve

.1 Acceptable master valves are Rain Bird EFP-CP Series valves.

.2 Master valve to be sized to maximum and minimum flow parameters as shown on Contract Drawings.

2.15 Pressure Reducing Valve

.1 Acceptable water pressure-reducing valves are Watts Series 25AUB-Z3.

2.16 Blow-Out Assembly

.1 Blowout assembly consists of a brass tee with a 25mm brass nipple, brass ball valve and plug.

2.17 Quick-Coupling Valve

.1 Acceptable quick coupling valves are as follows:
- (i) Rain Bird 3-RC
- (ii) Rain Bird 5-RC

2.18 Gate Valve

.1 For gate valves sized up to 50mm, acceptable gate valves include the following:
- (i) Red-White Valve 206AB LF brass gate valve.
- (ii) Toyo 206a.

.2 Acceptable gate valves that are sized greater than 50mm are as shown on Contract Drawings.

2.19 Poly Vinyl Chloride (PVC) Pipe

.1 New condition, extruded from virgin, high-impact materials, solvent weldable with belled ends, and continually and permanently marked showing manufacturer's name, material, size, and pressure rating.
- (i) For lateral piping: Class 200 PVC.
- (ii) For mainline piping: Schedule 40 PVC.

.2 The acceptable pipe sizes are 25mm, 38mm, 50mm, 64mm, 75mm, and 100mm. Pipe in quarter-inch increments will not be accepted.

2.20 Polyethylene (PE) Pipe

.1 New condition Series 100, in new condition, extruded from virgin materials, continually and permanently marked showing manufacturer name, material, size, and pressure rating.

2.21 High-Density Polyethylene (HDPE) Pipe

.1 New condition CSA Approved, extruded from virgin materials, continually and permanently marked showing manufacturer's name, materials, size, and pressure rating.

.2 The material will be listed by the Canadian Standards Association (CSA) and Plastic Pipe Institute (PPI) as a PE-3408 resin with a hydrostatic design basis (HDB) of 1600psi for water at 23ºC. It will also comply with ASTM D-1248 as a Type III Class C, Category 5, Grade P34 material and with ASTM D-3350 as a 345434C cell material.

.3 Acceptable HDPE pipe is dependent on operating pressure and to have Standard Density Ratios (SDR) as follows:
- (i) Maximum pressure up to 100 psi: SDR 17.0.
- (ii) Maximum pressure exceeding 100psi: SDR 11.0.

2.22 Sleeving

.1 Schedule 40 PVC for irrigation sleeve in a bored hole or under the hard surface.

.2 The diameter of the irrigation sleeve must be at least 50mm or twice the diameter of the pipe running through it, whichever is greater.

2.23 Fittings

.1 New condition Schedule 40 PVC conforms to ASTM D-2466-97 standards and is of the same material as the pipe. Fittings are to be designed for solvent welding to PVC pipe except where valves and risers require threaded joints.

.2 Nipples are to be threaded Schedule 80 PVC and manufactured from the same material as pipe.

.3 At the point where the supply source changes from metal to PVC pipe, the metal end of the pipe must be an FIPT (female) adapter and the PVC fitting a MIPT (male) adapter.

.4 Flange couplers may be used upon approval of the Contract Administrator.

.5 The fittings for the LDPE pipe are to be Spears insert fittings complete with stainless steel gear clamps.

.6 Fittings for HDPE pipe to be butt fusion type for end-to-end joints.

.7 The SDR rating of HDPE fittings must match the SDR rating of the HDPE pipe specified.

.8 HDPE pipe fittings must be moulded or fabricated by the pipe manufacturer. Contractors are prohibited from making HDPE pipe fittings and flange adapters.

.9 Fittings for driplines and drip emitters must be compatible with the specified dripline or emitter and as recommended by the manufacturer.

.10 All pipes and fittings installed in the irrigation vault are to be brass per Drawings.

2.24 Pipe Solvent and Primer

.1 PVC pipe solvent and primer combinations are recommended by the manufacturer and suitable for use with specified materials and applications.

.2 Use solvent and primer as directed by the manufacturer. Use only solvent and primer that meets local codes.

.3 The use of wet and dry solvents and primers is prohibited.

.4 Acceptable cement must be grey, medium or heavy-bodied PVC cement.

.5 Acceptable primers must be purple PVC primers.

2.25 Valve Boxes

.1 Acceptable irrigation valve boxes are NDS Pro-Spec valve boxes.

.2 The valve box, matching T Cover Lid, and extensions are to be commercial grade and green in colour.

.3 The valve box is to have a locking, overlapping lid with a stainless steel bolt locking device and appropriate washers.

2.26 Electric Control Valve

.1 Acceptable valves are as follows:
(i) Rain Bird’s PEB series valves
(ii) Toro’s P220 series.

.2 Size the electric control valve in accordance with the valve manufacturer’s recommendations for the design flow.

2.27 Swing Joint Assembly

.1 Acceptable swing joint assemblies for sprinklers flowing up to 8 gpm:
(i) Rain Bird SA Series Swing Assembly.

.2 For sprinklers flowing greater than 8gpm, use swing joints with three (3) threaded Schedule 40 PVC elbows and one threaded Schedule 80 PVC nipple.

.3 The nipple's length shall be sufficient to permit the installed head or valve to be set as specified.

.4 The diameter of the nipple to match the inlet for the valve or head is shown on the Contract Drawings.

2.28 Sprinklers - Sprayhead

.1 Acceptable sprayhead sprinklers are as follows:
(i) Rain Bird 1800-SAM-PRS, 1800-SAM-P45.

.2 Acceptable nozzles are Rain Bird MPR fixed-arc nozzles. Where fixed-arc nozzles do not fit the desired irrigated area, use Rain Bird HE-VANs or Rain Bird RVAN nozzles.

2.29 Sprinklers – Rotor

.1 Acceptable Rotors are:
(i) Rain Bird 5004-+-SAM-R Series
(ii) Rain Bird 6504 Series
(iii) Rain Bird 8005 Series
(iv) Rain Bird 11000 Series

2.30 Root Watering System

.1 Acceptable root watering systems are Rain Bird RWS Series, with size and depth specified on the Contract Drawings.

2.31 Tree Bubblers

.1 Acceptable bubblers are Rain Bird 1400 Series pressure compensating full-circle bubblers.

2.32 Drip Zone Kits

.1 Acceptable drip zone kits are as follows:
(i) 0.3 to 20 GPM: Rain Bird XCZ-100-PRB-COM
(ii) 15 to 40 GPM: Rain Bird XCZ-150-LCS

2.33 Filters

.1 Acceptable filters are as shown on the Contract Drawings.

2.34 Landscape Dripline

.1 The acceptable dripline are as follow:
(i) Rain Bird XFS-CV series.
(ii) Rain Bird XFDe On-Surface Dripline.

2.35 Drip Emitters

.1 Acceptable emitters are Rain Bird Xeri bugs, sized as shown on Contract Drawing.

2.36 Lateral Flush Assembly

.1 Ball valve with a street elbow on swing joint assembly complete with an NDS Pro-Spec 10” round valve box.

2.37 Air Relief Valves

.1 Acceptable air relief vales are Rain Bird ARV050 Air/Vacuum relief valves complete with NDS Standard Series 6” Round Emitter Box.

2.38 Thrust Block

.1 Thrust blocks to be 20MPa at 28-day strength. Thrust blocks can be either:
(i) Poured in place concrete.
(ii) Pre-cast concrete block.

2.39 Backfill Material

.1 Native excavated material shall be clean excavated soil, free from organic matter, stones larger than 25mm, building debris, and other foreign substances.

.2 Sand: pit run sand.

3.0 EXECUTION

3.1 Existing Conditions

.1 Report existing conditions at variance with Contract Drawings to the Contract Administrator.

.2 Verify the location of all services in building walls before boring or drilling holes. Make good all damages to same at Contractor's cost.

.3 Verify the locations of underground utilities prior to commencing excavation and conduct work to prevent interruption and damage to services and utilities. Make good all dames to same at Contractor's cost.

.3 Protect existing conditions and completed work from disturbance during Work. Make good all damages to same at Contractor's cost.

.4 Protect existing conditions and completed work from disturbance during Work. Make good all damages to same at Contractor's cost.

3.2 Layout

.1 The location of irrigation components shown on plans are schematic in nature. Coordinate the actual location of irrigation components with landscaping, building and physical features of the site. Confirm proposed changes to the location of irrigation components in writing with the Contract Administrator before installation. In the opinion of the Contract Administrator, changes that markedly alter the irrigation design require the submission of Shop Drawings and an updated Design Report to the Contract Administrator for their permission to proceed. Record all approved revisions on a marked-up set of Contract Drawings.

.2 Layout and stake irrigation system per Contract Drawings to confirm:

(i) Layout is within the project boundary and property lines.

(ii) Site grades are consistent with Contract Drawings.

(iii) Damage to the root system of existing trees is minimized.

(iv) Installation of irrigation components to be a minimum of 1 meter outside the dripline of existing trees.

(v) Minimum horizontal and vertical clearances from electrical and other utilities are met.

(vi) Location of all sleeving, mainlines, pedestals, vaults, valve boxes, and splice boxes.

3.3 Excavation

.1 Excavate to ensure depth and bedding requirements are met.

.2 Prior to excavation, report to the Contract Administrator any material or site condition that cannot be excavated by normal mechanical or normal means or that may affect excavation to the required depth.

.3 Identify and recycle all suitable materials recovered during construction.

.4 Remove and dispose of buried debris exposed during excavation, including decommissioned irrigation materials and underground utilities, which may impede the proper installation and operation of the irrigation system.

3.4 Irrigation Controller

.1 Install irrigation controller in the cabinet as per Contract Drawings.

.2 Coordinate controller installation with other electrical components.

.3 Install controller and wiring in accordance with local, provincial, and national electrical codes.

3.5 Controller Cabinet

.1 Install the controller cabinet in the location shown on Contract Drawings or in an alternate location approved or directed by the Contract Administrator.

.2 Install the controller cabinet in the location shown on Contract Drawings or in an alternate location approved or directed by the Contract Administrator.

.3 Install the controller cabinet using a poured-in-place concrete pad mount.

.4 Provide electrical service to controller cabinet as shown in Contract Drawings.

3.6 Control Wire

.1 Install control wire per code by qualified personnel employed by the company holding the electrical permit.

.2 Bed control wire in sand with a minimum of 75mm sand around the control wire. Where the control wire is in the same trench as the pipe, place the wire beside the pipe with a horizontal clearance of a minimum of 50mm and in accordance with BC Electrical Code depth.

.3 Bundle multiple lengths of wire in the same trench or conduit with ties at a maximum of 3.0m intervals.

.4 Install wire with 600mm length of coiled slack at all changes of direction, in wire splice boxes and at connections to controlled components.

.5 Identify all control wires entering the controller cabinet with a permanent label or tag indicating the zone number of the valve operated by each control wire.

.6 Maintain consistent wire colour through wire splice box.

.7 Identify spliced wire with a permanent label or tag indicating the zone number of the spliced control valve.

.8 Minimize wire splices. Where wire splices are unavoidable, make splices only in the wire splice box using a specified connector.

.9 Where specified on the Contract Drawings, install extra control wire in the wire splice box. Provide 600mm of coiled slack at each wire end in the wire splice box. Identify the extra control wire as an ‘extra’ wire with a permanent label or tag.

3.7 Grounding and Bonding

.1 Install ground assembly in the location shown on Contract Drawings or the revised location approved by the Contract Administrator.

.2 Use the rod, plate, and wire configuration recommended by the irrigation controller's manufacturer and per the BC Electrical Code.

3.8 Wire Splice Box

.1 Where possible, locate the wire splice box in the planting bed for ease of access, maintenance, and testing.

.2 Install wire splice box per Drawings and arrange in a neat and orderly manner.

.3 Do not install valves in the wire splice box.

3.9 Water Service and Account

.1 Establish a water utility account and obtain permits and approvals necessary to install and operate irrigation systems.

.2 Review regulations and restrictions imposed by applicable water utility with a Certified Irrigation Designer and advise the Contract Administrator of any regulations or restrictions that will affect the operation of the proposed irrigation system. Provide the Contract Administrator with options necessary to respond to any regulations or restrictions affecting the operation of the proposed irrigation system.

.3 Coordinate with water utility as required to confirm availability, suitability, and location of an acceptable service connection.

.4 Isolate water service before installation of any irrigation components.

3.10 Vault and Lid

.1 Install vault in location on Contract Drawings or in an alternate location approved or directed by Contract Administrator.

.2 Support and brace point of connection components, piping and valves within the vault using adjustable aluminum pipe stands complete with riser, pipe clamps, base plate and stainless-steel fittings in the quantity per service size indicated below.

(i) 19mm: 2 supports.

(ii) 25mm to 50mm: 3 supports.
(iii) 64mm and greater: 3 supports minimum per vault.

3.11 Vault Drain

.1 The vault drain consists of a minimum of $2m^3$ of 25mm drain rock wrapped in landscape fabric.

3.12 Backflow Prevention Assembly

.1 Install the Double Check Valve Assembly (DCVA) in a lockable concrete vault or a locked mechanical room, per the Contract Drawings.

.2 Install backflow prevention assembly in accordance with all applicable codes and bylaws and accordance with the current Cross Connection Control Manual Accepted Procedure and Practice (BCWWA).

.3 Support backflow prevention assembly with specified supports per the manufacturer's recommendations for locations of the support points.

3.13 Flow Sensor

.1 Install flow sensor in the location specified by Drawings.

.2 The flow sensor wire is to run continuously, with no splices, between the flow sensor and irrigation controller.

.3 There must be an unrestricted pipe for at least 10x the pipe's diameter upstream and 5x the pipe's diameter downstream of the tee.

.4 Follow the manufacturer's recommendations for the installation of a flow sensor and wiring.

3.14 Master Valve

.1 Install master valve per Contract Drawings.

3.15 Pressure Reducing Valve

.1 Install a pressure-reducing valve as shown on Contract Drawings.

3.16 Blow-Out Assembly

.1 Install the blow-out assembly immediately in a vault at the point of connection. If the point of connection is inside a building, install a blow-out connection immediately downstream of the isolation valve where the mainline pipe exits the building.

3.17 Quick Couplers

.1 Install in NDS Pro-Spec 10” Round valve per manufacturer’s recommendations and Contract Drawings.

3.18 Gate Valve

.1 Install in valve box per manufacturer’s recommendations and Contract Drawings.

.2 Where points of connections are located within a building, install an isolation valve immediately downstream of where the pipe exits the building, in a rectangular valve box.

3.19 Pipe and Fittings

.1 Verify that all pipes, fittings, primer, and cement are compatible for proper installation.

.2 Do not locate the open side of the trench any closer than 300mm from the hard surface or feature.

.3 Keep the inside of the pipe and outside of the pipe ends clean at all times. Cap or plug open pipe ends to keep out dirt and debris.

.4 Cut PVC pipe ends at a right angle to pipe length. Clean burrs prior to joining pipe and fittings.

.5 Immediately prior to joining pipe and fittings, wipe contact surfaces clean with primer.

.6 Apply a light coat pipe of cement on the inside of the fitting and a heavier coat on the outside of the pipe. Insert the pipe into the fitting and give a quarter turn to seat cement. Wipe excess cement from outside of the pipe.

.7 The Contract Administrator reserves the right to request that the Contract remove and replace any solvent weld joints that show smearing or runoff of primer or cement.

.8 The Contract Administrator reserves the right to request that the Contract remove and replace any solvent weld joints that show smearing or runoff of primer or cement.

.9 Flush all irrigation pipes fully to remove accumulation of dirt and debris prior to installation of heads, dripline, emitters, and filters. Flush all laterals in a manner

approved by the manufacturer to prevent clogging of screens, nozzles, and emitters.

.10 Conduct mainline pressure test and HDPE pipe strap test and obtain approval of Contract Administrator prior to backfilling lines.

.11 Sidewall fusion of HDPE is not acceptable.

.12 Set mainlines and laterals on and backfill with sand to clearance limit shown on Drawings.

.13 Install thrust blocks at all changes in the direction of PVC pipe 64mm in diameter or greater and for any change in the direction of the gasketed pipe.

.14 Install lateral piping at a 300mm to 450mm (12” to 18”) depth.

.15 Install mainline piping at a 600mm (24”) depth.

3.20 Sleeving

.1 Install irrigation sleeves in locations shown on Contract Drawings.

.2 Install sleeves to extend 1.0m past the edge of the hard surface into the soft landscape surface.

.3 Cap sleeve with removable plug or cover. Maintain plug in sleeve until such time as pipe or wire is ready to be installed.

.4 Bed sleeves as follows:

(i) Under walkways: 100mm of sand placed all around.

(ii) Under driveways, roads, and plazas: compacted base aggregate all around per materials shown on Contract Drawings.

.5 Bury a piece of detectable metal on top of each end of the sleeve to enable the location of the sleeve end by a metal detector after burial.

.6 The stakes should be placed at each end of the sleeve prior to backfilling so that the top of the stake is 300mm above the finished grade and maintained. The exposed

end of the stake should be labelled with the word "sleeve."

.7 Record the location of sleeve ends and label the size of the sleeve on record drawings.

.8 Remove sleeve stake after submission of Record Drawings.

3.21 Valve Boxes

.1 Install manual and electric control valves, control zone kits, and quick coupler valves in valve boxes or concrete vaults, as shown on the Drawings.

.2 Except as shown otherwise on Contract Drawings or approved otherwise by the Contract Administrator, locate valve boxes in planting beds and locate them for ease of access, maintenance, and testing.

.3 Install the valve box flush with the finish grade and arrange it in a neat and orderly manner.

.4 Provide a minimum 50mm clearance between the valve box and all components within and between the valve and the top of the drain rock.

.5 The valve box must not contact the irrigation pipe. Use 300mm height-matching valve box extensions as required.

.6 Up to three (3) 25mm control valves or two (2) 38mm control valves may be contained within a single valve box, provided there is 100mm of clearance between valves. Install valves 50mm and larger in their own valve box.

.7 Install a minimum of four (4) bricks below all corners of the valve box. The bricks shall not intrude into the valve box's space.

.8 Wrap all valve boxes in landscape fabric before burial to prevent material from sloughing into the valve box.

.9 Install drain rock 100m past the valve box edges at a 150mm depth before installing the valve.

3.22 Electric Control Valve

.1 Install in valve box per manufacturer's recommendations and Contract Drawings.

.2 Identify the electric control valve with a permanent label or tag indicating the zone number of the valve.

.3 Install a 25mm Schedule 40 PVC ball valve upstream of each valve. For larger valves, install a gate valve sized to match the valve.

3.23 Swing Joint Assembly

.1 Install swing joint assembly to rotate counterclockwise when depressed.

.2 Tape threads of PVC fittings with Teflon tape and make hand tight.

3.24 Sprinklers

.1 Install per manufacturer's recommendations and in the location shown on Contract Drawings.

.2 The location of heads, as illustrated on the Contract Drawings, is intended as a guide to the layout of heads. Establish actual head locations in the field to ensure complete and adequate coverage of all areas to be irrigated and no overspray onto adjacent surfaces and improvements. Do not exceed the head spacing shown on the Contract Drawings.

.3 Where obstructions or site improvements hinder or block head-to-head coverage, advise the Contract Administrator and determine the best method to maximize coverage.

.4 For flat surfaces, install the head plumb to the finished grade. For sloped surfaces, install the head perpendicular to half the grade of the slope.

.5 Mount pop-up heads on the triple swing joint assembly. Connect the sprinkler's bottom inlet to the swing joint assembly, not the side inlet. Adjust the swing joint assembly to set the head flush with the finish grade. Tape the threads of the PVC fittings with Teflon tape and make the hand tight.

.6 Adjust arc, radius of coverage and flow at each sprinkler to achieve even head-to-head coverage of the area to be irrigated, with minimum over-spray onto other surfaces.

3.25 Root Watering System

.1 Install root watering system as follows:

(i) Install sock over the canister.

(ii) Position units evenly spaced around the root ball and adjacent to the root zone within the tree's canopy.

(iii) Fill the canister with pea gravel to 50mm below the bubbler.

(iv) Connect to lateral pipe with Rain Bird SPX Series Swing Pipe and Rain Bird SB Series Spiral Barb fittings.

(v) Cover the grate with duct tape or landscape fabric to prevent the ingress of foreign material during construction. Remove it prior to Substantial Completion.

3.26 Tree Bubblers

.1 Tree bubblers are to be installed on temporary systems.

.2 Install the bubbler as follows:

(i) Set bubbler to grade.

(ii) Install bubbler directly to Rain Bird SA Series swing assembly.

3.27 Drip Zone Kit

.1 Install in valve box per manufacturer’s recommendations and Contract Drawings.

.2 Identify the electric control valve with a permanent label or tag indicating the zone number of the valve.

.3 Drip zone kits shall include one (1) schedule 40 PVC ball valve and filter.

.4 Drip zone kits to include ball valve, filter, and pressure regulating module.

3.28 Filters

.1 Install the filter in the same valve box as a valve, per the manufacturer’s recommendations and Contract Drawings.

3.29 Landscape Dripline

.1 Do not install driplines or emitters of different flow lengths or spacing on the same zone.

.2 Place the dripline on the prepared surface. The surface must be free of sharp rocks or other objects that may damage it. It must also be at the grade necessary for the dripline to be at the specified depth after the remainder of the topsoil or growing medium is placed.

.3 Placement of the dripline by trenching using hand or mechanical methods is permitted only if specified as such on the Contract Drawings or upon written approval of the Contract Administrator.

.4 Thoroughly flush each zone after installation and before beginning regular operation of the drip zone.

.5 Stake dripline in beds every 450mm on centre.

.6 Make all zone connections and test the manifold header, lines, and fittings for leaks before placing topsoil or growing medium over the manifold, headers, dripline, and emitters.

3.30 Dripline Headers

.1 Dripline headers are to be constructed using Prime 100 Low-Density Polyethylene pipe with Spears insert fittings and stainless steel gear clamps.

3.31 Drip Emitters

.1 Install per manufacturer's recommendations and as shown on Contract Drawings.

3.32 Lateral Flush Assembly

.1 Install flush assembly on swing joint in NDS Pro-Spec 10" Round valve box.

.2 Install flush valve assembly at the end of each leg or section of dripline and the end of each leg of lateral on a root watering system zone.

3.33 Air Relief Valve

.1 Install air relief valve at the highest point of elevation of the dripline in a bed or on a zone. Install in NDS 6" Round Emitter valve box.

3.34 Thrust Block

.1 Place the thrust block to support the pipe joints from separating, not to prevent the pipe from heaving. Do not cover the top of the pipe with concrete thrust blocking at change from a horizontal alignment to a vertical alignment.

.2 For thrust blocks installed in disturbed soils, increase the thrust block area by 50%.

.3 Place 2 ply of 6mil polyethylene between the pipe and thrust block.

.4 Allow the concrete to set before backfilling the trench or pressurizing the line.

.5 Obtain approval from the Contract Administrator prior to backfilling the thrust block.

3.35 Clean Up and Restoration

.1 Remove all waste and debris from the site resulting from irrigation installation.

.2 Restore all disturbed surfaces to their original condition and repair all settlement at trenches or around valve boxes.

3.36 Instructions to Owner

.1 Instruct Owner in complete operating and maintenance procedures for irrigation system, including start-up, winterization, and programming.

.2 Review Record Drawings and Operating Manual with the Owner on site.

3.37 General Maintenance

.1 Inspect, operate, maintain, and adjust the irrigation system through the Landscape Maintenance Period until issuance of Certificate of Acceptance to ensure it operates as intended, including but not limited to:

(i) Adjust the irrigation schedule to ensure the survival, health, and growth of plant material and respond to soil conditions, climate, and seasons at the site.

(ii) Clean sprinkler heads and adjust coverage to eliminate over watering, under watering and overspray onto adjacent surfaces.

(iii) Monitor and clean filtration equipment.

(iv) Restore grass areas, planting beds, hard surfaces and improvements affected by trench settlement and erosion.

(v) Respond to requests from the Contract Administrator for program adjustments, servicing, adjustments, and repairs.

3.38 Maintenance – Winterization

.1 During the Maintenance Period, the company is responsible for winterizing the irrigation system at the end of the growing season and prior to the onset of air temperatures below 0º Celsius. The company is liable for any damage resulting from late or improper winterization.

.2 Request the presence of the Owner at winterization at least five days prior to the proposed winterization date.

.3 Winterization includes but is not limited to:
(iii) Deactivation of controller.
(iv) Drainage and blow-out of the entire irrigation system.

3.39 Maintenance – Spring Start-Up

.1 During the Maintenance Period, be responsible for the spring start-up of the irrigation system at the beginning of the growing season or within 10 days of the request for start-up from the Owner. Be liable for any damage resulting from late or improper start-up.

.2 Ensure the Owner is present for the spring start-up. Request the owner's presence at least five days before the proposed start-up.

.3 Spring start-up includes but is not limited to:
(i) Checking and testing for leaks.
(ii) Cycling irrigation control program through all zones to ensure proper function and performance.
(iii) Checking and adjusting heads and emitters to achieve even coverage with minimum overspray onto other surfaces.
(iv) Test backflow prevention assembly. Submit test results to the Contract Administrator.
(v) Saturation of soil with water to a depth of 12” to provide deep watering of all lawn areas, planting beds and tree pits.

3.40 Guarantee

.1 Submit a written guarantee, in approved form, stating that all work showing defects in materials, workmanship, or operation will be repaired or replaced at no cost to the Owner for a period of one year from the date of Substantial Performance.

.2 The guarantee will not apply to materials or workmanship damaged after Substantial Performance by causes beyond the Contractor's control, such as vandalism or abuse.

END OF SECTION